

## REMARKS/ARGUMENTS

Favorable consideration of this application is respectfully requested. No new matter, no new issues and no new considerations have been raised by this response. Applicants have amended the specification, cancelled claim 21, and amended claim 22 to more clearly set forth Applicants' invention and to reduce issues in the application. The present amendment is necessitated by the Final Office Action. Favorable reconsideration of this application is, consequently, earnestly solicited in view of the following remarks.

1. Applicants acknowledge that an information disclosure statement must comply with 37 CFR 1.52 and that the references cited in US Patent 6,624,420 have been listed on an enclosed PTO-892.
2. Applicants acknowledge that the drawings received by the examiner on 5 April 2004 are acceptable.
3. The amendment filed 5 April 2004 has been objected to under 35 U.S.C. 132 because it introduced new matter into the disclosure. The Office Action states that "The added material which is not supported by the original disclosure is as follows: 'multi-phonon' (the paragraph at page 4, line 9 to page 5, line 1) has been changed to -multi-photon-." The Applicants respectfully contend that no new matter has been introduced and that the term "multi-phonon" is a typographical error. A phonon is defined as "a quantum of sound energy" whereas a photon is defined as "a quantum of electromagnetic energy having both particle and wave properties: it has no charge or mass but possesses momentum and energy" (Webster's New World Dictionary, Third College Edition, 1988). The Examiner's attention is directed to the paragraph on page 4, line 9 to page 5, line 1 wherein the basic *scintillation* process is discussed and the term "multi-photon" is used to describe relaxation processes that limit the amount of electron-hole recombination energy to *luminescence* centers (emphasis added). It is well known in the art that scintillation and luminescence deal with electromagnetic energy, that is photons, and not sound energy. In addition, the Examiner's attention is directed to the discussion on page 12, lines 12 – 13 of the figure that "illustrates the structure of the scintillation device with the crystal of the invention optically connected to the photomultiplier or other *photon* detector" (emphasis added). Thus, applicants contend that the term "multi-photon" is not new material and removal of the objection is respectfully requested.
4. The Examiner has objected to the specification as failing to provide proper antecedent basis for the claimed subject matter. The Applicants have amended the specification to provide the proper antecedent basis for the claimed subject matter as indicated by the Examiner.
5. The Examiner has objected to the form of the disclosure as a Divisional and suggests that the application should be a Continuation-In-Part. The Office Action states " the winning party of the interference is not denied anything he or she was in possession of prior to the interference, nor does he or she acquire any additional rights as a result of the interference ..." The Applicants respectfully contend that the application has been properly filed as a Divisional and that the parent application, now U.S. Patent No. 6,624,420, encompasses the subject matter of the amendments made to the present application. The amendments made to the specification do not raise new subject matter. The Applicants are not aware of any restriction in the MPEP that prohibits the filing and prosecution of this application as a divisional. This issue is further discussed below.
6. Claim 21 has been rejected under 35 U.S.C. 102(b) as being anticipated by Kurata et al. (US 5,690,731). The Office Action states that "... Kurata et al disclose a composition for

detection of energy radiation (column 1, lines 18 – 20) comprising a cerium doped lutetium yttrium orthosilicate mono crystal (*i.e.*, a Ce doped  $R_2SiO_5$  single crystal where R is at least one rare-earth element selected from the group consisting of La, Ce, Pr, Nd, Pm, Sm, Eu, Tb, Dy, Ho, Er, Tn, Yb, Lu, Y, and Sc...)" Claim 21 has been cancelled and claim 22 has been amended to more clearly and distinctly set forth Applicants' invention.

Kurata et al. does not disclose applicant's claimed composition, *i.e.* "...a composition for the detection of high energy radiation comprising: a cerium doped lutetium yttrium orthosilicate mono crystal wherein the crystal includes: a monocrystalline structure of cerium doped lutetium yttrium orthosilicate,  $Ce_{2x}(Lu_{1-y}Y_y)_{2(1-x)}SiO_5$  where either x = approximately 0.00001 to approximately 0.05 and y = approximately 0.0001 to approximately 0.9999" or x = approximately 0.0001 to approximately 0.001 and y = approximately 0.3 to approximately 0.8; and alternatively a "... crystal scintillator comprising a transparent single crystal of cerium-activated lutetium yttrium oxyorthosilicate having the general formula  $Lu_{(2-x-z)}Y_xCe_zSiO_5$ , with  $0.001 \leq z \leq 0.02$  and either  $0.05 \leq x \leq 1.95$  or  $0.2 \leq x \leq 1.8$ ." The Kurata et al. patent is to a method of growing crystals of cerium-doped gadolinium oxyorthosilicate (GSO), an already known material whose scintillation properties had already been demonstrated. Kurata et al. states in column 4, lines 6-16, that "... The same effects as with the use of gadolinium oxyorthosilicate *would be obtained* with the use of another single crystal of a rare-earth silicate represented by the following general formula:



wherein R represents at least one rare-earth element selected from the group consisting of La, Ce, Pr, Nd, Pm, Sm, Eu, Tb, Dy, Ho, Er, Tn, Yb, Lu, Y, and Sc, in view of the similarity in the mechanical properties of the crystals..." (emphasis added). While Kurata et al. states that any of these combinations form a crystal scintillator that can take the place of GSO, one skilled in the art would know that many of these combinations cannot produce a crystal scintillator. Single crystals of a rare-earth silicate represented by the general formula  $R_2SiO_5$  where R is only one rare earth, *i.e.*  $Pr_2SiO_5$ ,  $Nd_2SiO_5$ ,  $Pm_2SiO_5$ ,  $Sm_2SiO_5$ ,  $Eu_2SiO_5$ ,  $Tb_2SiO_5$ ,  $Dy_2SiO_5$ ,  $Ho_2SiO_5$ ,  $Er_2SiO_5$ ,  $Tm_2SiO_5$ ,  $Yb_2SiO_5$ ,  $Lu_2SiO_5$ ,  $Y_2SiO_5$ ,  $Ce_2SiO_5$ ,  $La_2SiO_5$ , and  $Sc_2SiO_5$  cannot produce crystal scintillators because they lack a doped activator.

While cerium-activated oxyorthosilicates  $Lu_2SiO_5$  (LSO) and cerium-activated  $Y_2SiO_5$  (YSO) are known crystal scintillators, Kurata et al. does not mention that they lose their scintillation properties when an excess concentration of activator is present. Kurata does not specify any concentration or range of concentrations for a metal/activator combination to produce crystal scintillators. Kurata et al. seems to suggest that any combination will produce a crystal scintillator. The combination of a known activator with one of the metals suggested by Kurata et al. does not guarantee the production of a single crystal scintillator. The preparation of crystal scintillators comes about by trial and error; first, a crystal must be grown and only then can its scintillation properties be determined experimentally. There is no guarantee that any particular combination of elements can produce a solid solution of those elements and form a crystal, or that the crystal will be a crystal scintillator. As presented in Table 1 and illustrated in Fig. 3 and Fig. 4 of the present application, the light yield and effective Z of a LYSO crystal varies significantly and unpredictably as the percentage of Lu in the LYSO crystal is varied. Significant experimentation is required to produce new crystal scintillators.

The Examiner's attention is respectfully directed to McClellan (US 6,323,489) wherein Kurata et al. is cited as a reference. Please note that the previous examiner for the parent application of the present application determined, in Interference No. 105,083, that the molecular

formula in the McClellan composition was the same as the molecular formula in the parent application and that the ranges in both the parent application and the McClellan patent are “anticipated or made obvious in view of each other under the principles set forth in MPEP §§ 2131.03 and 2144.05”. The Examiner’s rejection of claim 21 in the present application is at odds with the prior determination, by the Examiner and his Supervisor, that the McClellan composition was not anticipated by Kurata et al.

7. Applicant acknowledges the presumption that the subject matter of the various claims was commonly owned by the Applicants at the time the inventions covered therein were made.

8. Claims 22-29 were rejected under 35 U.S.C. 103(a) as being unpatentable over Kurata et al. (US 5,690,731) in view of Berkstresser et al. (US 5,164,041). Applicants respectfully disagree, as applicants have shown that Kurata et al. does not anticipate applicants’ claimed composition, i.e. Kurata et al. does not disclose applicant’s claimed composition, i.e. “...a composition for the detection of high energy radiation comprising: a cerium doped lutetium yttrium orthosilicate mono crystal wherein the crystal includes: a monocrystalline structure of cerium doped lutetium yttrium orthosilicate,  $Ce_{2x},(Lu_{1-y}Y_y)_{2(1-x)}SiO_5$  where either  $x =$  approximately 0.00001 to approximately 0.05 and  $y =$  approximately 0.0001 to approximately 0.9999” or  $x =$  approximately 0.0001 to approximately 0.001 and  $y =$  approximately 0.3 to approximately 0.8; and alternatively a “... crystal scintillator comprising a transparent single crystal of cerium-activated lutetium yttrium oxyorthosilicate having the general formula  $Lu_{(2-x-z)}Y_xCe_zSiO_5$ , with  $0.001 \leq z \leq 0.02$  and either  $0.05 \leq x \leq 1.95$  or  $0.2 \leq x \leq 1.8$ .”. Berkstresser et al. does not supply what is missing from Kurata et al. Berkstresser et al. in combination with Kurata et al. does not provide applicants’ claimed composition or any properties thereof. The composition must first be made so that the properties can be measured.

9. Claims 30, 31, and 34-39 were rejected under U.S.C. 103(a) as being unpatentable over Kurata et al. (US 5,690,731) in view of Berkstresser et al. (US 5,164,041) and Fitzpatrick (US 5,500,147). The Office Action states that “...it would have been obvious to one having ordinary skill in the art at the time of the invention that the photodetector in the detector of Kurata et al. is selected from the group of known scintillator photodetectors such as photomultiplier tubes or charge-coupled devices, in order to detect light from the optically coupled crystal scintillator.” Applicants respectfully disagree. Applicants have shown that Kurata et al. does not anticipate applicants claimed composition, and Berkstresser et al and Fitzpatrick do not supply what is missing from Kurata et al. to provide applicants’ claimed composition, scintillator, or any properties thereof.

10. Claims 32 and 33 were rejected under U.S.C. 103(a) as being unpatentable over Kurata et al. (US 5,690,731) in view of Berkstresser et al. (US 5,164,041) and Fitzpatrick (US 5,500,147) as applied to claim 31 above, and further in view of Melcher et al (J. of Crystal growth 128:1001-1005, 1993) and Loutts et al. (J. of Crystal Growth 174:331-336, 1997). The Office Action states that “...it would have been obvious to one having ordinary skill in the art at the time of the invention that the scintillator of Kurata et al. has a ~420 nm luminescence wavelength and a ~35-45 ns luminescence decay time since luminescence arises from the 5d-4f transitions in  $Ce^{3+}$  as taught by Melcher et al. and combinations of small rare-earth ions (i.e. Lu and Y) in a rare-earth oxyorthosilicate monoclinic lattice will have physical properties (eg. luminescence emission) almost linearly varying with combination as taught by Loutts et al.” Applicants respectfully disagree, as applicants have shown that Kurata et al. does not anticipate applicants’ claimed scintillator. Melcher et al. in combination with Loutts et al. in combination with Kurata et al. do

not provide applicants' claimed composition, scintillator, or any properties thereof. The composition must first be made so that the properties can be measured.

In summary, many of the combinations suggested by Kurata et al. to replace GSO do not form crystal scintillators, and some do not even form single crystals. The preparation of crystal scintillators comes about by trial and error, where a crystal is first prepared so that its scintillation properties may be determined experimentally. There is no guarantee that any particular combination of elements can produce a crystal, and further that the crystal will be a crystal scintillator. Significant experimentation is required to produce new crystal scintillators.

Applicants' claimed crystal scintillator having the chemical formula  $Ce_{2x},(Lu_{1-y}Y_y)_{2(1-x)}SiO_5$ , where either  $x =$  approximately 0.00001 to approximately 0.05 and  $y =$  approximately 0.0001 to approximately 0.9999 or  $x =$  approximately 0.0001 to approximately 0.001 and  $y =$  approximately 0.3 to approximately 0.8; and alternatively  $Lu_{(2-x-z)}Y_xCe_zSiO_5$ , with  $0.001 \leq z \leq 0.02$  and either  $0.05 \leq x \leq 1.95$  or  $0.2 \leq x \leq 1.8$ , is neither anticipated by nor inherent in Kurata et al., nor obvious in view of Kurata et al. in combination with any aforementioned reference.

11. Applicants acknowledge that the terminal disclaimer, disclaiming the terminal portion of any patent granted on this application which would extend beyond the expiration date of U.S. Patent No. 6,624,420, has been reviewed and accepted.

12. The Office Action states that "...unless applicant is asserting that the instant claims are identical to previously allowed claims, MPEP § 2363.02 is not applicable." MPEP § 2363.02, Winning Party, provides that "If prosecution of the winning party's application had not been closed, the winning party generally may be allowed additional and broader claims to the common patentable subject matter." Further "The winning party of the interference is not denied anything he or she was in possession of prior to the interference, nor does he or she acquire any additional rights as a result of the interference." The Applicants respectfully contend that claims 30 – 39, incorporated from Interference 105,083, are not new matter and that the claims have basis in the parent application. The previous examiner for the parent application determined, in Interference No. 105,083, that the molecular formula in the McClellan composition was the same as the molecular formula in the parent application and that the ranges in both the parent application and the McClellan patent are "anticipated or made obvious in view of each other under the principles set forth in MPEP §§ 2131.03 and 2144.05". Further, the Interference Initial Memorandum notes that the luminescence wavelength and the luminescence decay time recited in the McClellan claims were made obvious by the principle of inherency in the composition. Applicants respectfully contend that the specification of the parent application and now divisional application provide basis for the claimed subject matter of claims 30 – 39. Applicants are not aware of any requirement in the MPEP that the claims must be identical. The Patent Office determined in the Interference that all claims of the McClellan patent were the same, or substantially the same, as claims of the original application and thus that applicants possessed the claimed subject matter prior to the interference.

MPEP § 706.04, Rejection of Previously Allowed Claims, states that "Full Faith and Credit should be given to the search and action of a previous examiner unless there is a clear error in the previous action or knowledge of other prior art. In general, an examiner should not take an entirely new approach or attempt to reorient the point of view of a previous examiner, or make a new search in the mere hope of finding something. *Amgen, inc. v. Hoechst Marion Roussel, Inc.*, 126 F. Supp. 2d 69, 139, 57 USPQ2d 1449, 1499-50 (D. Mass. 2001). The Office Action has not provided any substantive arguments why claims 30 – 39 of the present application have been rejected when the claimed subject matter was determined, by a previous examiner, to

have been supported and encompassed by the specification of the parent application. The Applicants respectfully contend that claims 30 –39 were previously allowable under the parent application and that they are entitled to the claimed subject matter of claims 30 – 39 in this divisional application. Further, any the potential issues of double patenting have been overcome by the terminal disclaimer filed by the Applicants.

The Applicants respectfully contend that the present invention provides new and unexpected results (i.e., improved scintillation properties) over Kurata et al. and Berkstresser et al. or any combination thereof. The Office Action states "...this argument is unpersuasive since applicant fails to provide evidence of unexpected results (i.e., improved scintillation properties) over the cited prior art". The Examiner's attention is respectfully directed to Table 1 (page 10, lines 1 – 14) wherein the experimental results for four intermediate LYSO charge compositions are compared to compositions of YSO and LSO. Light yield for two of the LYSO compositions is superior to the LSO composition. Light yield for all of the LYSO compositions is superior to the YSO composition.

In view of the foregoing considerations, it is respectfully urged that the above amendment be entered, and all rejections over claims 22 - 39 be removed and the claims be allowed. If the Examiner believes that an additional interview would be helpful or a further affidavit by the Applicants, the Examiner is requested to contact the attorney at the below listed number. Alternatively, Applicants request that this amendment be entered in order to reduce issues for appeal. Again, applicant invites the examiner to contact the undersigned for an interview or a further affidavit by the Applicants if such would be helpful.

Respectfully Submitted;

  
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